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## S P E C I F I C A T I O N

### Clamping Method with Improve Bolt Retention

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## BACKGROUND OF THE INVENTION

### Field of the Invention

This invention was conceived as an improvement over prior art methods employed in the clamping and unclamping of shaker screens in media separating shaker machines. However, it will be evident that the present invention has broader applications where it is beneficial to prevent bolts from rotating while tightening and loosening nuts installed thereon.

### Description of the Related Art

In large media separating shaker machines the media is fed into the machine which is vibrating under power to move the media such as gravel of various sizes over stacked tears of screens, each screen having a progressively smaller mesh spacing than that above. The vibrations or shaking action of the machine causes a separation of the media into groups by size. The shaker screens must from time to time be removed from the machine for maintenance and cleaning. To facilitate the removal and installation of the shaker screens they are fashioned having sides with edges at the top of the sides turned inward. A clamping rail with a "C", "U", or channel shaped cross section is used to engage the inward turned top edges on each side of the shaker screens. The clamping rail has holes along its length for receiving bolts through it and through holes in the side of the machine so nuts can be installed on the bolts from the outside and tightened to draw the clamping rail into fast engagement

with the top edge of the shaker screen and the inside wall of the machine.

In most cases of the prior art the bolts used to secure the clamping rail to the screen and the machine are standard type carriage bolts. The clamping rail has a series of square holes along its length to receive the carriage bolts. Carriage bolts are used because the space between the screens inside the machine does not permit a bolt with a hex or other type head to be reached with a wrench. Also, a hex or other type head would be eroded by abrasive action from contact with the media to the point that a wrench would not hold it while loosening the nuts from the outside. Another significant problem with the prior art is that the space limitations require that the clamping rail be maneuvered into position from outside the machine from one end with all the bolts inserted in the clamping rail. In such a semi-blind and tedious operation it is near impossible to keep some of the bolts from backing out and falling into the machine and become lost in the media.

In one attempt of the prior art the bolts use are of special design. The bolts have no threads and the end opposite the bolt head has a slot lengthwise for receiving a wedge. The wedge avoids the issue with the bolts rotating when the nuts are rotated but it incurs a problem of its own in that the vibration of the machine loosens the wedges.

## SUMMARY OF THE INVENTION

The present invention solves the problem of bolts rotating when the nuts on the outside are turned. It also solves the problem of bolts falling out when installing the clamping rail or when removing it. This invention gives a method of retaining the bolts in the clamping rail such that the non-round section, or square section in the case of a conventional carriage bolt, stays in engagement with the non-round, or square holes, during the total operation of installing or removing the clamping rail from the machine.

The inventive methods for retaining the non-round, or square, portion of the bolts in the non-round, or square holes in the clamping rail include adding a cross-hole in the bolt in or near the junction of the threaded portion of the bolt and the non-round, or square, portion. The bolts are passed through the clamping rail so that engagement is made by the non-round portion of the bolts with the non-round holes in the clamping rail and pins are inserted into the cross-holes so as to hold the engagement while rotating nuts on or off the bolts thus preventing rotation of the bolts. Alternatively, instead of a cross-hole in the bolt, a groove can be used at or near the junction of the threaded portion of the bolt and the non-round, or square, portion. Then when the bolts are passed through the clamping rail an engagement is made by the non-round portion of the bolts with the non-round holes in the clamping rail, clips or clip rings are inserted over the groove to hold the engagement while rotating nuts on or off the bolts with the bolts being

prevented from rotating.

Another alternative method is to use a retention device that has an internal opening that deforms as the device is passed onto the bolt so that it will not slide back, thus holding the non-round portions engaged. An example would be the use of an internal tooth washer that has teeth that deflect back as the washer is forced onto the bolt threads. Likewise one could use an arched speed nut or other push type nut to accomplish this method.

In cases where space allows, standard hex nuts can serve the purpose of holding the non-round portions in engagement by threading them onto the bolts against the non-round portion after the bolts have been passed through the first member or rail. Then with the bolts thus retained in this first member or rail they can be passed through the second member or machine frame en bloc so a second set of nuts can be threaded on the bolts from the outside and made tight. However, in a vibration environment the inner retainer nuts tend to shake loose with their purpose being defeated.

This specification defines and claims the subject matter of the invention. The drawings along with the description of the preferred embodiment will serve to assist in the understanding of the invention and its operation.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an end view of a media separating machine showing prior art.

Figure 2 is a perspective view of a clamping rail and bolts of the prior art.

Figure 3 is a side view of a carriage bolt with cross-hole added.

Figure 4 is a section view of the preferred embodiment of the invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 is a simplified view of the end of a media separating shaker machine assembly showing clamping rail 1, carriage bolt 2, shaker screen 3, shaker machine frame 4, threaded nut 5. Figure 1 is a depiction of the prior art.

Figure 2 is a perspective view of the clamping rail 1 containing a series of square holes for receiving the square portion of carriage bolts 2. Figure 2 is a depiction of the prior art.

Figure 3 is a side view of carriage bolt 2 modified by adding a cross-hole for use in the method of this invention.

Figure 4 is a section showing assembly of the present invention with cotter key 6 inserted in the cross-hole in modified carriage bolt 2 (shown in this illustration 90 degrees out of rotation to give full view of cotter key 6).

The method of the preferred embodiment is effected by assembling modified carriage bolts 2 into clamping rail 1 and installing cotter keys 6 in the cross holes in modified carriage bolts 2 on the opposite side of clamping rail 1 from the heads

of carriage bolts 2 which retains the bolts in engagement with the square portion of carriage bolts 2 in the square holes in clamping rails 1.

This assembly comprised of clamping rail 1, carriage bolts 2, and cotter keys 6 can now be maneuvered into place inside the media separating shaker machine with engagement of carriage bolts 2 effected with holes in the side of the media separating shaker machine frame 4 without carriage bolts 2 backing out and falling from clamping rail 1 because they are retained by cotter keys 6. As the assembly is positioned into place with carriage bolts 2 engaging holes in the media separating shaker machine frame 4 from the inside, the lower edge of clamping rail 1 contacts the inside curved area of shaker screen 3 and the upper edge of clamping rail 1 contacts the side of media separating shaker machine frame 4, nuts 5 can then be installed on carriage bolts 2 from the outside of media separating shaker machine frame 4 without carriage bolts 2 rotating while nuts 5 are tightened. Tightening nuts 5 causes clamping rail 1 to draw tight against shaker screen 3 keeping shaker screen 3 clamped to the side of the media separating shaker machine frame as the machine vibrates.

A major benefit of the method of this invention occurs when shaker screens 3 are to be removed from the media separating shaker machine. After use in a moist and gritty environment removing nuts 5 in prior art applications is a problem of some consequence. In the prior art nuts 5 can be loosened to a point and then the slack that results allows carriage bolts 2 to back out of square engagement.

Then nuts 5 and carriage bolts 2 rotate together preventing further loosening. Because of space limitations between shaker screens 3 there is no adequate way to reach inside and press against the heads of carriage bolts 2 to hold them in square engagement. In the present invention carriage bolts 2 are retained from backing out of square engagement in clamping rail 1 as little or no slack occurs when loosening nuts 5. Therefore, removal of the clamping rail or freeing it from clamping action by loosening nuts 5 is not hindered.

Although the best mode contemplated for carrying out this invention has been shown in the preferred embodiment, alternate approaches are disclosed and it is apparent that modifications and variations of this method may be made without departing from what is the subject matter of this invention.